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Angler Effort and Harvest of Coho Salmon During the Recreational Fisheries in the Lower Kenai River, 1991

by

S. L. Hammarstrom

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ANGLER EFFORT AND HARVEST OF COHO SALMON DURING THE RECREATIONAL FISHERIES IN THE LOWER KENAI RIVER, 1991[1]

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ABSTRACT

A creel survey was conducted from 1 August through 30 September 1991 on two sections on the Kenai River (between the Soldotna Bridge and Cook Inlet, and between Skilak Lake and Naptowne Rapids) to estimate recreational angler effort and catch and harvest of coho salmon *Oncorhynchus kisutch*. The recreational fisheries in these two sections of the river during this period primarily target coho salmon. Based on this survey, recreational anglers fishing during the early (August) coho salmon run expended an estimated 206,037 angler-hours to catch an estimated 49,756 coho salmon. Estimated angler-effort and harvest during the late (September) coho salmon run were 104,867 angler-hours and 26,712 coho salmon, respectively. During both runs, most of the effort and catch were estimated to have occurred in the downstream section. The release component during both runs was less than 2.5% (1,066 and 226 coho salmon for the early and late runs, respectively). Over both runs, unguided anglers exerted 78% of the total effort and harvested 55% of the coho salmon harvest while guided anglers exerted 22% of the effort and harvested 45% of the coho salmon. Shore anglers accounted for little of the effort or harvest during either run. The coho salmon harvest during both runs was sampled for age and sex composition. Age-2.1 coho salmon predominated both runs (74% and 82% for the early and late runs, respectively). More females were harvested than males during both the early and late runs (53% and 55%, respectively).

KEY WORDS: Kenai River, coho salmon, creel survey, effort, harvest, *Oncorhynchus kisutch*.

INTRODUCTION

Background

Early and late stocks of coho salmon *Oncorhynchus kisutch* return annually to the Kenai River (Figure 1). The early stock typically enters the river from late July through August while the late stock typically begins entering the river in early September. There has been no determination on exactly how long the late stock return occurs; however, fish have been observed spawning into late March. Early-run fish are believed to spawn predominantly in tributaries of the Kenai River while late-run fish are believed to spawn predominantly in the mainstem (Booth *In prep*).

The early and late coho salmon stocks of the Kenai River support the largest freshwater sport fishery for coho salmon in Alaska. Effort and harvest in these recreational fisheries have generally increased annually since 1976 to where recreational effort and harvest now exceed 150,000 angler-hours and 30,000 coho salmon for the early run, and 100,000 angler-hours and 20,000 coho salmon for the late run (Figure 2). The economic value of these fisheries during 1986 was estimated at $3.9 million for the early run and $4.6 million for the late run (Jones and Stokes 1987). At that time, recreational anglers also expressed an additional net willingness to pay for these fisheries of $3 million for the early run and $2.8 million for the late run.

The early and late coho salmon stocks of the Kenai River also contribute significantly to the mixed-stock commercial fisheries that occur in the marine waters of Upper Cook Inlet (UCI). The coho salmon harvest in these fisheries is second only to the coho salmon harvest in Southeast Alaska. During the period 1977 through 1989, these fisheries harvested an average of just over 450,000 coho salmon. Kenai River coho salmon stocks also support various subsistence and personal-use fisheries in UCI. Although harvests in these fisheries have been relatively small to date, recent allocative decisions by the Alaska Board of Fisheries may increase harvests.

There is currently a lack of quantifiable data regarding the Kenai River coho salmon stocks. Primarily, the stock-specific contributions of Kenai River coho salmon in the mixed-stock fisheries and the escapement of Kenai River coho salmon stocks is unknown. As a result, levels of harvest or exploitation which are sustainable for the early and late Kenai River coho salmon stocks are currently unknown and definition of meaningful management and research objectives for these stocks is lacking. In the face of uncertainty, the prudent approach is to manage Kenai River coho salmon stocks and exploiting fisheries conservatively. However, the growing nature of the fisheries exploiting these stocks, coupled with the lack of quantifiable information, does not speak to conservative management and raises fears that these stocks may be in danger of overexploitation.

To provide data required to define meaningful management objectives and strategies, a long-term study has been initiated to assess the status and sustained yields of the early and late Kenai River coho salmon stocks. Details regarding this study have been previously described in the Goal Statement and Study Plan for the Development of a Stock Assessment Program for Upper Cook Inlet Coho Salmon Stocks (Meyer et al. *Unpublished*). As part of this long-term effort, the recreational harvests of early- and late-run coho

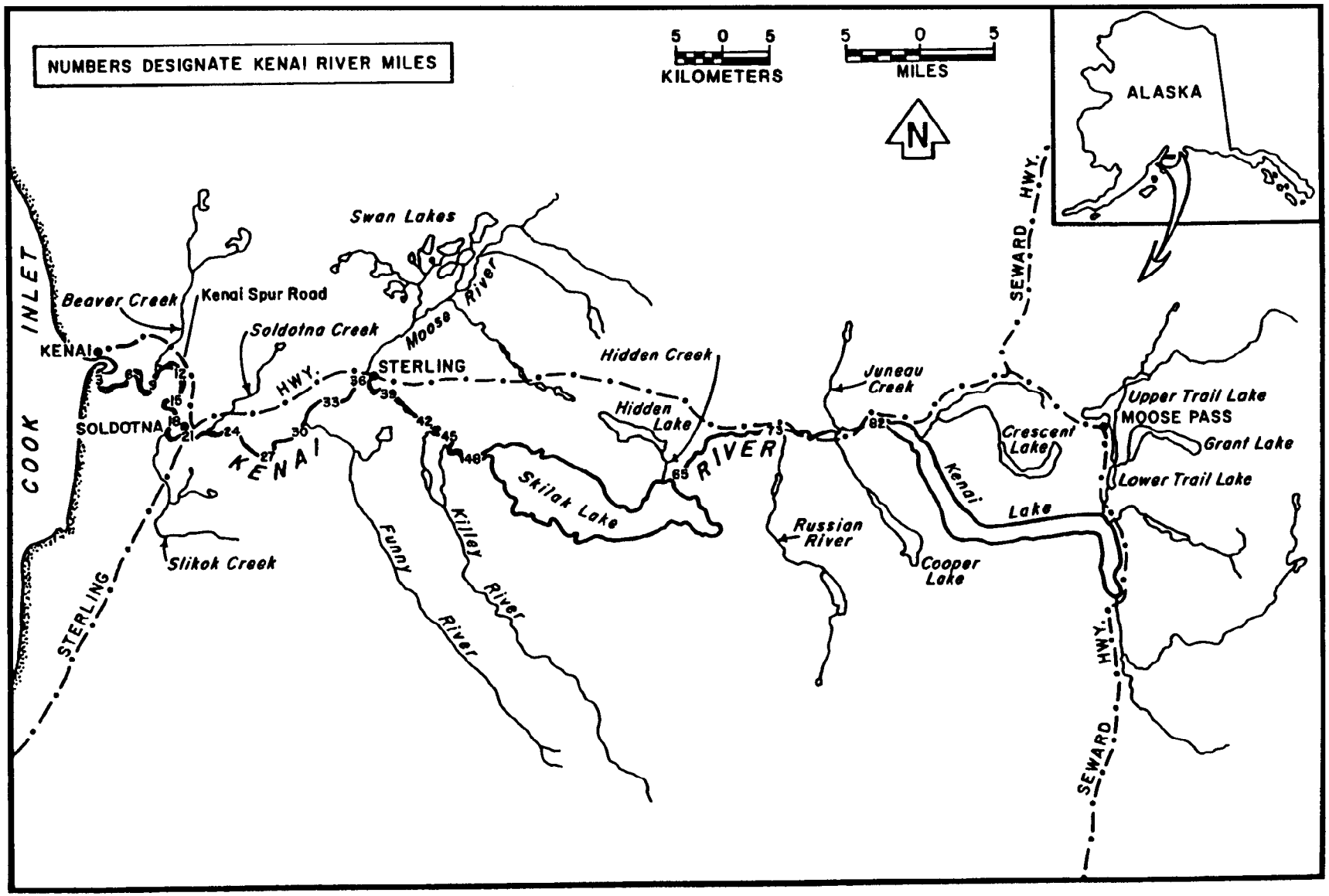

Figure 1. Map of the Kenai River drainage, Alaska.

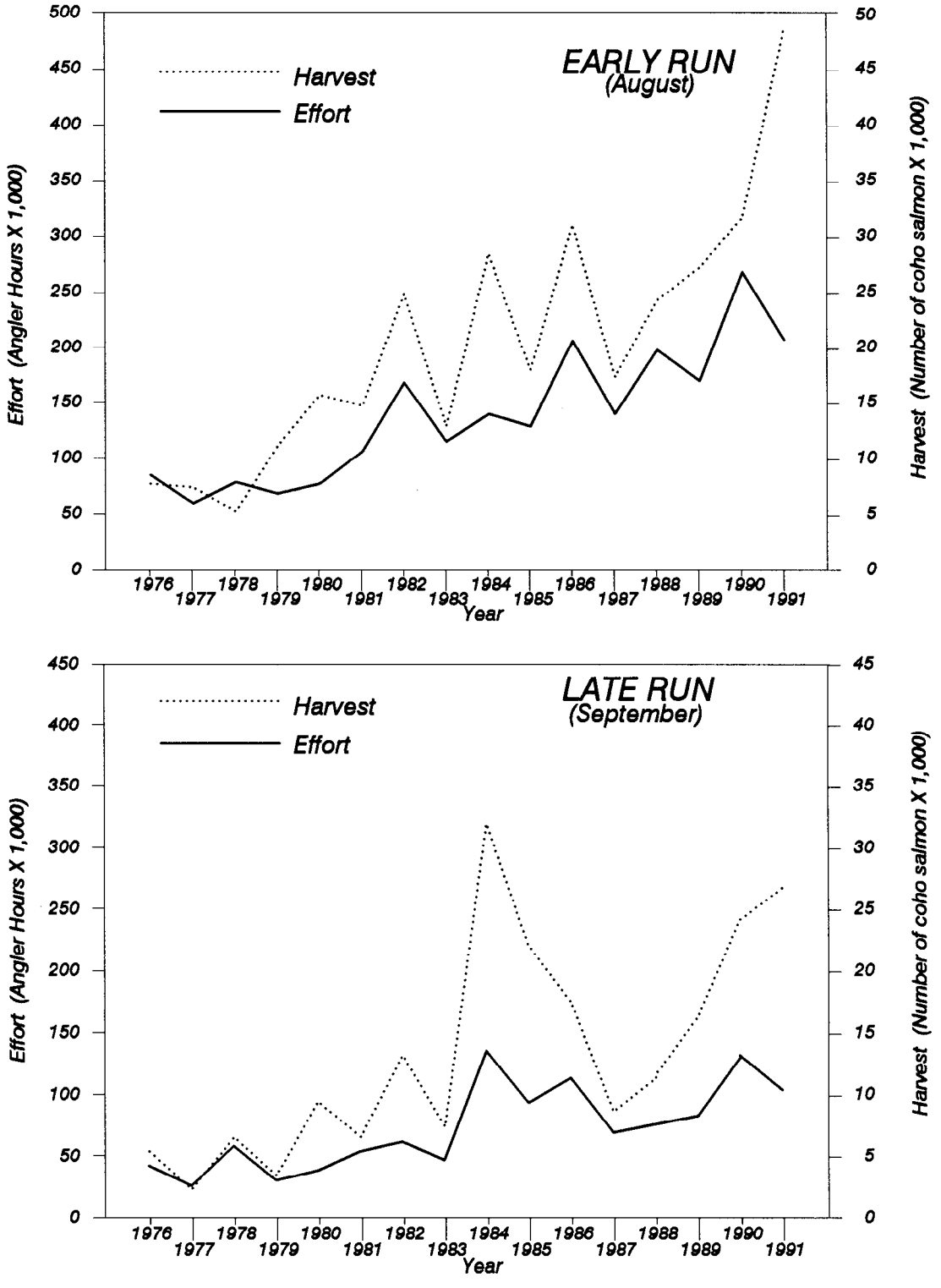

Figure 2. Historical harvest and effort in the recreational fishery for coho salmon in the Kenai River, 1976-1991.

salmon stocks in the Kenai River are annually estimated. In combination with other studies, results of these efforts will provide the data necessary to estimate the productivity of the Kenai River coho salmon resource. This information will be used to define meaningful management objectives and strategies to assure sustained yield of this resource.

Description of the Kenai River Coho Salmon Fishery

The recreational fishery targeting coho salmon in the Kenai River usually begins after the closure of the chinook salmon fishery 31 July. During most years, anglers have reported few coho salmon being caught during the directed chinook salmon fishery prior to 1 August. Although late-run coho salmon continue to enter the river after 1 October, effort typically drops off significantly due to cold weather and shorter daylight time.

The directed coho salmon fishery in the Kenai River is unlike that which targets chinook salmon *O. tshawytscha*. During the chinook salmon fishery, anglers typically drift or troll their gear. However, during the coho salmon fishery, anglers typically motor their boats to a favorite "hole", anchor, and fish with roe resting on the bottom or cast brightly colored lures. These boat anglers typically access the river at developed boat launches and campgrounds. In addition, shore anglers fish for coho salmon along the banks of the Kenai River. Although in the past most of the anglers have been unguided, in recent years guided boat anglers have accounted for a larger portion of the recreational effort.

Most anglers targeting coho salmon fish in the mainstem Kenai River either downstream from the Soldotna Bridge or from Skilak Lake to the Naptowne Rapids. Although coho salmon are harvested in the mainstem between these two river sections, past surveys have shown the numbers to be small (less than 15% of the harvest in the other mainstem areas).

Previous information pertaining to the coho salmon fishery in the Kenai River has been presented in Hammarstrom (1977, 1978, 1988-1991), Wallis and Hammarstrom (1979-1984), Hammarstrom et al. (1985), Hammarstrom and Larson (1986), and Conrad and Hammarstrom (1987). In addition, angler-effort and harvest by species for the recreational fishery in the Kenai River was estimated by Mills (1979-1991).

Regulations Governing the Sport Fishery

For the Kenai River, coho salmon fall under an aggregate bag and possession limit for other salmon. The aggregate daily bag and possession limit in effect during the 1991 recreational fishery were three fish 41 cm in length or greater with no annual limit.

FY92 Objectives

The objectives of the FY92 (1991 summer season) studies were to:

1. estimate total harvest and catch of coho salmon in the mainstem Kenai River downstream from the Soldotna Bridge and from Skilak Lake to the Naptowne Rapids during the period from 1 August through 30 September 1991;

2. estimate recreational angler effort in the mainstem Kenai River downstream from the Soldotna Bridge and from Skilak Lake to the Naptowne Rapids during the period from 1 August through 30 September 1991; and,

3. estimate the age, sex, and size compositions of coho salmon harvested during the recreational fishery in the mainstem Kenai River downstream from the Soldotna Bridge and from Skilak Lake to the Naptowne Rapids during the period from 1 August through 30 September 1991.

METHODS

Creel Survey

A roving creel survey (Neuhold and Lu 1957) was used to estimate sport fishing effort (in units of recreational angler-hours fished). Angler interviews were used to estimate both harvest per unit of effort (HPUE, in units of numbers of coho salmon harvested per angler-hour fished), and catch per unit of effort (CPUE, in units of numbers of coho salmon caught per angler-hour fished). Harvest and catch were estimated as the product of the estimated effort and HPUE or CPUE estimates. Harvest refers to fish retained by anglers as part of their creel and catch refers to fish retained plus those reported to be released by anglers.

The survey was based on a two-stage sample design. The first stage represented days surveyed and the second stage represented anglers and counts within a period. The fishing day was stratified into two periods, morning and afternoon. For each period, the days that period was sampled were randomly chosen, and once a day had been chosen, the entire period was sampled. The survey was also stratified according to geographical (downstream from Cook Inlet upstream to the Soldotna Bridge, and upstream area, from the Naptowne Rapids upstream to the outlet of Skilak Lake) and temporal (early run, August, and late run, September) strata. Sampling was further stratified into morning (0600-1359 hours) and afternoon (1400-2159 hours) strata. Sampling in the downstream strata was further stratified into weekday and weekend (Saturdays, Sundays, and legal holidays) strata. In addition to these geographical and temporal strata, the data were post-seasonally stratified into boat and shore anglers, and for the downstream strata into guided and unguided anglers. Thus, there were a total of 24 strata in the downstream area and 12 in the upstream area:

Downstream Strata

1. August weekday morning unguided boat
2. August weekday afternoon unguided boat
3. August weekend morning unguided boat
4. August weekend afternoon unguided boat
5. August weekday morning guided boat
6. August weekday afternoon guided boat
7. August weekend morning guided boat
8. August weekend afternoon guided boat
9. August weekday morning unguided shore
10. August weekday afternoon unguided shore
11. August weekend morning unguided shore

12. August weekend afternoon unguided shore
13. September weekday morning unguided boat
14. September weekday afternoon unguided boat
15. September weekend morning unguided boat
16. September weekend afternoon unguided boat
17. September weekday morning guided boat
18. September weekday afternoon guided boat
19. September weekend morning guided boat
20. September weekend afternoon guided boat
21. September weekday morning unguided shore
22. September weekday afternoon unguided shore
23. September weekend morning unguided shore
24. September weekend afternoon unguided shore

Upstream Strata

1. August morning unguided boat
2. August afternoon unguided boat
3. August morning guided boat
4. August afternoon guided boat
5. August morning unguided shore
6. August afternoon unguided shore
7. September morning unguided boat
8. September afternoon unguided boat
9. September morning guided boat
10. September afternoon guided boat
11. September morning unguided shore
12. September afternoon unguided shore

Sampling levels were designed to estimate effort to within ±15% and harvest and catch to within ±30% of their true values 95% of the time. In the downstream section, 25 days were scheduled for sampling during August (18 weekday days: 10 mornings and 9 afternoons, and 7 weekend days: 6 mornings and 3 afternoons). Twenty-two days were scheduled for sampling during September in the downstream section (13 weekday days: 7 mornings and 9 afternoons, and 9 weekend days: 6 mornings and 4 afternoons). In the upstream section, 15 days were selected for sampling during August (8 mornings and 7 afternoons) and 21 days during September (13 mornings and 12 afternoons). Some deviation of the schedule did occur because of mechanical breakdown and/or other duties such as public assistance or enforcement activities. Three people conducted the survey: one stationed in the downstream area, one in the upstream area, and one which roved between the two areas (but predominantly operated in the downstream area).

Angler counts were conducted during all scheduled sampling periods. Counts were conducted by a clerk using a boat driven at a constant rate of speed through the length of the survey area, starting at one extremity of the area. The trip usually took 45 minutes or less to complete and every effort was made to insure the trip was completed within 1 hour. Angler counts were therefore considered instantaneous and reflected fishing effort at the time of the count. During each count, the survey clerk recorded the following information: (1) total number of unguided boats, (2) total number of guided boats, (3) total number of anglers in unguided boats, (4) total number of anglers in guided boats, and (5) total number of shore anglers.

Angler interviews were also conducted during all scheduled sampling periods in each geographic area. This allowed angler counts (effort) to be paired with those for angler interviews (HPUE or CPUE estimates). The interviews were conducted by the clerks conducting the angler count survey in that area and augmented by the roving creel technician. The interviews were conducted at two randomly selected access locations. Interview periods lasted 3.5 hours at each location during August and 3.0 hours at each location during September. The clerks tried to interview all anglers departing the fishery at each surveyed access site during a survey period. The following information was obtained for each interviewed angler: (1) where the angler fished, (2) whether the angler fished from a boat or shore (and if a boat was used whether it was a motorized or non-motorized boat), (3) whether the angler was guided or unguided, (4) whether the angler completed fishing or not, (5) the total numbers of hours the angler fished, (6) the total number of fish the angler harvested (kept) by species, and (7) the total number of fish the angler released by species. Only interviews for anglers with completed trips were used to compute CPUE and HPUE estimates.

Total effort, catch, and harvest were estimated by expanding means over all periods sampled in a stratum h. For any period i sampled, a minimum of three counts were made unless mechanical failure compromised the schedule. The mean count x_i for period i was estimated as:

$$\bar{x}_i = \frac{\sum_{j}^{r} x_{ij}}{r_i} \quad ; \tag{1}$$

where:

x_{ij} = the number of anglers observed in the jth count of period i, and
r_i = the number of counts in period i, which should be three.

Starting times for angler counts were systematically drawn within a period and the variance of the mean angler count was estimated as:

$$Var(\bar{x}_i) = \frac{\sum_{j=2}^{ri} (x_{ij} - x_{i(j-1)})^2}{2\, r_i(r_i-1)} \quad . \tag{2}$$

Effort for period i in stratum h was estimated as:

$$\hat{E}_{hi} = L_h \bar{x}_i \quad ; \tag{3}$$

where:

$\hat{E}_{hi}$ = effort for period i in angler-hours, and

L_h = length of period in hours in stratum h, which was 8 hours in August and 6 hours in September.

The variance of the estimated effort for period i in stratum h was estimated as:

$$\mathrm{Var}(\hat{E}_{hi}) = L_{h2}\,\mathrm{Var}(x_i) \quad . \tag{4}$$

The mean effort for stratum h was estimated as:

$$\bar{E}_h = \frac{\sum_{i=j}^{d} \hat{E}_{hi}}{d} \quad ; \tag{5}$$

where:

$\bar{E}_h$ = mean effort for stratum h, and

d = number of periods (or days) sampled in stratum h.

In the downstream section, days sampled in each period (morning or afternoon) were chosen randomly. The variance of mean effort for the downstream strata was estimated as:

$$S_{Ehi2} = \frac{\sum_{i=1}^{d} (\hat{E}_{hi} - \bar{E}_h)^2}{(d-1)} \quad . \tag{6}$$

In the upstream section, days were chosen systematically and the variance was then estimated as:

$$S_{Ehi2} = \frac{\sum_{i=1}^{d} (\hat{E}_{hi} - \hat{E}_{h(i-1)})^2}{2(d-1)} \quad . \tag{7}$$

Total effort for strata h was estimated as:

$$\hat{E}_h = D\ \bar{E}_h \ ; \tag{8}$$

where:

$\hat{E}_h$ = total effort for stratum h, and

D = total number of periods in stratum.

The variance of total effort for the stratum was estimated as:

$$Var(E_h) = (1-f)\, D^2 \frac{S_{Ehi^2}}{d} + D \frac{\sum_{i=1}^{d} \hat{Var}(E_{hi})}{d}. \quad (9)$$

Catch and harvest per unit of effort were estimated for each period sampled for angler interviews using jackknife methods in order to minimize the bias of these ratio estimators (Efron 1982).

A jackknife estimate of CPUE (or HPUE) was made for each angler as:

$$\overset{*}{CPUE}_{hij} = \frac{\sum_{1 \neq j}^{mhi} c_{hil}}{\sum_{1 \neq j}^{mhi} e_{hil}} \quad ; \quad (10)$$

where:

$CPUE_{hij}$ = jackknife estimate for angler j,

c_{hil} = catches for all anglers interviewed in period i except angler j,

e_{hil} = hours fished for all anglers interviewed in period i except angler j, and

m_{hi} = number of anglers interviewed in period i.

The jackknife estimate of mean CPUE for period i was the mean of the angler estimates:

$$\overline{\overset{*}{CPUE}}_{hi} = \frac{\sum_{j=1}^{mhi} \overset{*}{CPUE}_{hij}}{m_{hi}} \quad (11)$$

and the bias corrected mean was estimated as:

$$\overline{\overset{**}{CPUE}}_{hi} = (m_{hi} (\overline{CPUE}_{hi} - \overline{\overset{*}{CPUE}}_{hi})) + \overline{\overset{*}{CPUE}}_{hi} \quad (12)$$

where:

$\overline{CPUE}_{hi}$ = the standard estimate of CPUE, or the sum of all catches over the sum of all hours fished in a period.

The variance of the jackknife estimate of CPUE was estimated as:

$$\mathrm{Var}(\overline{\mathrm{CPUE}}_{hi}^{**}) = \frac{(m_{hi} - 1)}{m_{hi}} \sum_{j=1}^{mhi} (\mathrm{CPUE}_{hij}^{*} - \overline{\mathrm{CPUE}}_{hi}^{*})^2. \quad (13)$$

The estimate of HPUE was made as for CPUE, substituting angler harvest for angler catch in equations (10) through (13) above.

Catch for the sample period was then estimated as the product of effort and CPUE as:

$$\hat{C}_{hi} = \hat{E}hi \; \overline{\mathrm{CPUE}}hi^{**} \quad (14)$$

and the variance as:

$$\mathrm{Var}(C_{hi}) = \mathrm{Var}(E_{hi})\ \mathrm{CPUE}_{hi}^2 + \mathrm{Var}(\mathrm{CPUE}_{hi})\ E_{hi}^2 - \mathrm{Var}(\mathrm{CPUE}_{hi})\ \mathrm{Var}(E_{hi}). \quad (15)$$

Harvest for sample period i was estimated using equations (14) and (15).

Total catch and harvest for stratum h was estimated using equations (5) through (9) above for effort, substituting estimated sample period catch (C_{hi}) or harvest (H_{hi}) for sample period effort (E_{hi}).

The estimate of total effort, catch, or harvest and their variances were summed across strata as these estimates were considered independent.

The major assumptions necessary for these analyses were:

1. significant fishing effort occurred only between the hours defined for the angler day;
2. individual effort and harvest (or catch) by anglers were normally distributed random variables; and,
3. anglers were interviewed in constant proportions to their abundance within each stratum (DiCostanzo 1956) and interviewed anglers were representative of the total angler population.

Age, Sex, and Size Data

Coho salmon observed in angler's creels during the interview surveys were systematically selected (the first five fish observed by the interview clerks) for biological sampling. For each run, a sample of 125 coho salmon were obtained. This sample size allowed for estimates of age composition of the harvests that were within ±10% of their true values 95% of the time, allowing for 15% scale regeneration (Thompson 1987). For each fish, the mid-eye to fork-of-the-tail length was measured to the nearest one-half centimeter, the sex identified, and three scales removed from the preferred area (Clutter and Whitesel 1956). Scales were placed on adhesive-coated cards and impressions of scale cards were made on acetate. Resultant scale impressions were used to determine ages using a microfiche reader.

Proportional age composition (p_{ht}) of the coho salmon harvests during each run was estimated. Letting p_{ht} equal the estimated proportion of age group h in component t, the variance of p_{ht} was estimated as (Scheaffer et al. 1979):

$$\hat{V}(p_{ht}) = \hat{p}_{ht}(1-\hat{p}_{ht})/(n_{ht}-1) \quad (16)$$

where n_{ht} equals the number of legible scales read from coho salmon sampled during component t.

RESULTS AND DISCUSSION

Creel Statistics

Angler counts and interviews were conducted on 25 of 31 possible days in August, and 22 of 30 possible days in September in the downstream section. In the upstream section, 15 of 31 days during August and 19 of 30 days during September were sampled.

Effort:

Downstream Section. Between one and six angler counts were conducted on each sampled day in the downstream section. During the early run in the downstream section, angler counts ranged from 22 to 420 for unguided anglers, from 0 to 241 for guided anglers, and from 8 to 176 for shore anglers (Appendix A1). The largest count of unguided anglers occurred on 17 August, of guided anglers on 8 August, and of shore anglers on 1 August. During the late run, angler counts ranged from 21 to 377 for unguided anglers, from 4 to 413 for guided anglers, and from 5 to 96 for shore anglers (Appendix A2). The largest count of both unguided and guided anglers occurred on 7 September and of shore anglers on 1 September.

The greatest estimated daily effort during the early run for unguided anglers occurred on 17 August (3,016 angler-hours), on 8 August for guided anglers (1,784 angler-hours), and on 1 August for shore anglers (1,408 angler-hours) (Appendices B1-B3). During the late run, greatest daily effort for unguided anglers occurred on 21 September (2,094 angler-hours), on 7 September for guided anglers (1,428 angler-hours) and on 1 September for shore anglers (504 angler-hours) (Appendices B4-B6).

The estimated effort in the downstream section during the early run was 161,208 (SE = 6,990) angler-hours (Table 1). More effort occurred during the morning hours (Period A) than the evening hours (Period B) for guided anglers, however, the opposite was true for both unguided and shore anglers. During the early run, 75% of the total effort was by unguided anglers. The estimated effort in the downstream section during the late run was 80,947 (SE = 1,553) angler-hours (Table 1). More effort occurred during the morning hours than the evening hours for all anglers. During the late run, 72% of the total effort was by unguided anglers.

Upstream Section. Between one and three angler counts were conducted on each sampled day in the upstream section. During the early run in the upstream section, angler counts ranged from 4 to 227 for unguided anglers, from 0 to 37

Table 1. Estimated effort during each stratum of the fishery for coho salmon in the downstream section of the Kenai River, 1991.

Angler Type	WE/WD[a]	Estimated Effort	Standard Error	95% Confidence Interval			Relative Precision
			AUGUST				
Period A (0600-1359 hours)							
Guided	WD	21,114	3,070	15,097	-	27,130	28.5 %
	WE	8,548	1,238	6,121	-	10,975	28.4 %
Unguided	WD	23,066	3,342	16,516	-	29,615	28.4 %
	WE	16,360	2,006	12,429	-	20,291	24.0 %
Shore	WD	12,160	2,067	8,109	-	16,212	33.3 %
	WE	4,968	430	4,125	-	5,811	17.0 %
Total Period A		86,216	5,532	75,373	-	97,058	12.6 %
Period B (1400-2159 hours)							
Guided	WD	8,250	1,024	6,244	-	10,256	24.3 %
	WE	2,186	525	1,157	-	3,216	47.1 %
Unguided	WD	32,237	3,388	25,597	-	38,877	20.6 %
	WE	12,418	1,944	8,607	-	16,228	30.7 %
Shore	WD	14,021	1,178	11,713	-	16,330	16.5 %
	WE	5,880	538	4,826	-	6,934	17.9 %
Total Period B		74,993	4,273	66,618	-	83,367	11.2 %
Total August		161,208	6,990	147,508	-	174,908	8.5 %
			SEPTEMBER				
Period A (0800-1359 hours)							
Guided	WD	9,978	175	9,635	-	10,321	3.4 %
	WE	7,525	711	6,131	-	8,919	18.5 %
Unguided	WD	14,009	453	13,121	-	14,897	6.3 %
	WE	15,225	1,016	13,233	-	17,217	13.1 %
Shore	WD	3,814	71	3,675	-	3,954	3.6 %
	WE	3,100	186	2,735	-	3,465	11.8 %
Total Period A		53,651	1,347	51,011	-	56,291	4.9 %
Period B (1400-1959 hours)							
Guided	WD	3,693	311	3,083	-	4,302	16.5 %
	WE	1,870	143	1,590	-	2,150	15.0 %
Unguided	WD	9,145	568	8,032	-	10,258	12.2 %
	WE	7,343	310	6,737	-	7,950	8.3 %
Shore	WD	2,755	207	2,349	-	3,161	14.7 %
	WE	2,490	136	2,224	-	2,756	10.7 %
Total Period B		27,296	772	25,782	-	28,810	5.5 %
Total September		80,947	1,553	77,903	-	83,990	3.8 %

[a] WE = Weekend, WD = Weekday.

for guided anglers, and from 0 to 288 for shore anglers (Appendix A3). The largest count of unguided anglers occurred on 31 August, of guided anglers on 23 August, and of shore anglers on 1 August. During the late run, angler counts ranged from 6 to 169 for unguided anglers, from 0 to 21 for guided anglers, and from 0 to 19 for shore anglers (Appendix A4). The largest count of unguided anglers occurred on 21 September, of guided anglers on 1 September, and of shore anglers on 29 September.

The greatest estimated daily effort during the early run for unguided anglers occurred on 31 August (1,472 angler-hours), on 23 August for guided anglers (244 angler-hours), and on 1 August for shore anglers (2,036 angler-hours). During the late run, greatest daily effort for unguided anglers occurred on 21 September (958 angler-hours), on 21 September for guided anglers (102 angler-hours), and on 29 September for shore anglers (99 angler-hours) (Appendices C1-C3).

The estimated effort in the upstream section during the early run was 44,829 (SE = 8,632) angler-hours (Table 2). More effort occurred during the morning hours (Period A) than the evening hours (Period B) for all. During the early run, 91% of the total effort was by unguided anglers. The estimated effort in the upstream section during the late run was 23,290 (SE = 2,267) angler-hours (Table 2). Again, more effort occurred during the morning hours than the evening hours for all anglers. During the late run, 89% of the total effort was by unguided anglers.

Harvest and Catch:

Downstream Section. A total of 1,262 completed-trip angler interviews were conducted in the downstream section, 728 during the early run and 534 during the late run. The greatest daily catch and harvest for guided anglers during the early run occurred on 15 August (Period A) when an estimated 1,960 coho salmon were caught and harvested (Appendix B1) and on 21 September (Period A) during the late run when 794 fish were caught and harvested (Appendix B4). Corresponding numbers for unguided anglers during the early run were 21 August (Period A) with an estimated catch and harvest of 791 coho salmon (Appendix B2) and 21 September (Period A) when 1,255 fish were caught and harvested (Appendix B5). The greatest daily harvest and catch for shore anglers during the early run occurred on 1 August when an estimated 352 coho salmon were caught and harvested (Appendix B3). No coho salmon were estimated to have been caught or harvested by shore anglers during the late run (Appendix B6).

The total estimated harvest and catch of coho salmon during the early run were 41,660 (SE = 6,235) and 42,034 (SE = 6,272), respectively (Tables 3 and 4). The total estimated harvest and catch of coho salmon during the late run were 23,340 (SE = 3,234) and 23,339 (SE = 3,234), respectively (Tables 3 and 4). For both fisheries, virtually all fish caught were retained. Significantly more fish were harvested during the morning hours (Period A) than during the evening hours (Period B) during each run. Guided anglers accounted for 52% of the early run harvest and 41% of the late run harvest. Shore anglers accounted for proportionally the least amount of the catch or harvest during either run. Harvest rates during the early run peaked around 15 August and during the late run around 22 September (Figure 3).

Table 2. Estimated effort during each stratum of the fishery for coho salmon in the upstream section of the Kenai River, 1991.

Angler Type	WE/WD	Estimated Effort	Standard Error	95% Confidence Interval	Relative Precision
			AUGUST		
Period A (0600-1359 hours)					
Guided	(All Days)	2,614	709	1,224 - 4,004	53.2 %
Unguided	(All Days)	14,813	4,322	6,341 - 23,285	57.2 %
Shore	(All Days)	10,432	6,530	0 - 23,230	122.7 %
Total Period A		27,859	7,863	12,447 - 43,270	55.3 %
Period B (1400-2159 hours)					
Guided	(All Days)	1,388	387	630 - 2,146	54.6 %
Unguided	(All Days)	9,696	1,687	6,388 - 13,003	34.1 %
Shore	(All Days)	5,887	3,112	0 - 11,986	103.6 %
Total Period B		16,970	3,561	9,991 - 23,950	41.1 %
Total August		44,829	8,632	27,911 - 61,747	37.7 %
			SEPTEMBER		
Period A (0800-1359 hours)					
Guided	(All Days)	1,775	220	1,344 - 2,206	24.3 %
Unguided	(All Days)	12,053	1,942	8,245 - 15,860	31.6 %
Shore	(All Days)	1,008	189	637 - 1,378	36.8 %
Total Period A		14,835	1,964	10,986 - 18,684	25.9 %
Period B (1400-1959 hours)					
Guided	(All Days)	870	218	443 - 1,297	49.1 %
Unguided	(All Days)	7,208	1,096	5,061 - 9,356	29.8 %
Shore	(All Days)	1,006	186	642 - 1,371	36.2 %
Total Period B		9,085	1,133	6,865 - 11,304	24.4 %
Total September		23,920	2,267	19,476 - 28,363	18.6 %

[a] WE = Weekend, WD = Weekday

Table 3. Estimated harvest during each stratum of the fishery for coho salmon in the downstream section of the Kenai River, 1991.

Angler Type	WE/WD[a]	Estimated Harvest	Standard Error	95% Confidence Interval			Relative Precision
			AUGUST				
Period A (0600-1359 hours)							
Guided	WD	12,712	3,783	5,297	-	20,127	58.3 %
	WE	6,109	3,324	0	-	12,624	106.6 %
Unguided	WD	10,322	2,271	5,870	-	14,774	43.1 %
	WE	2,157	723	740	-	3,574	65.7 %
Shore	WD	2,581	2,399	0	-	7,283	182.2 %
	WE	101	93	0	-	283	179.8 %
Total Period A		33,982	6,067	22,092	-	45,872	35.0 %
Period B (1400-2159 hours)							
Guided	WD	1,863	399	1,081	-	2,645	42.0 %
	WE	1,048	944	0	-	2,899	176.6 %
Unguided	WD	3,770	872	2,061	-	5,479	45.3 %
	WE	646	358	0	-	1,348	108.7 %
Shore	WD	351	365	0	-	1,066	203.6 %
	WE	0	0	0	-	0	
Total Period B		7,678	1,440	4,856	-	10,500	36.7 %
Total August		41,660	6,235	29,439	-	53,881	29.3 %
			SEPTEMBER				
Period A (0800-1359 hours)							
Guided	WD	4,753	971	2,850	-	6,656	40.0 %
	WE	3,308	1,941	0	-	7,112	115.0 %
Unguided	WD	5,897	898	4,137	-	7,657	29.8 %
	WE	4,776	2,166	530	-	9,022	88.9 %
Shore	WD	0	0	0	-	0	
	WE	0	0	0	-	0	
Total Period A		18,734	3,195	12,472	-	24,996	33.4 %
Period B (1400-1959 hours)							
Guided	WD	1,274	200	881	-	1,667	30.8 %
	WE	199	57	87	-	311	56.4 %
Unguided	WD	2,032	354	1,339	-	2,725	34.1 %
	WE	1,101	292	529	-	1,673	52.0 %
Shore	WD	0	0	0	-	0	
	WE	0	0	0	-	0	
Total Period B		4,606	504	3,619	-	5,593	21.4 %
Total September		23,340	3,234	17,000	-	29,680	27.2 %

[a] WE = Weekend, WD = Weekday.

Table 4. Estimated catch during each stratum of the fishery for coho salmon in the downstream section of the Kenai River, 1991.

Angler Type	WE/WD[a]	Estimated Catch	Standard Error	95% Confidence Interval	Relative Precision
			AUGUST		
Period A (0600-1359 hours)					
Guided	WD	12,780	3,787	5,357 - 20,204	58.1 %
	WE	6,110	3,324	0 - 12,624	106.6 %
Unguided	WD	10,560	2,365	5,924 - 15,195	43.9 %
	WE	2,157	723	740 - 3,574	65.7 %
Shore	WD	2,581	2,399	0 - 7,283	182.1 %
	WE	101	93	0 - 282	180.1 %
Total Period A		34,288	6,105	22,322 - 46,254	34.9 %
Period B (1400-2159 hours)					
Guided	WD	1,863	399	1,080 - 2,645	42.0 %
	WE	1,048	944	0 - 2,899	176.6 %
Unguided	WD	3,837	871	2,130 - 5,544	44.5 %
	WE	646	358	0 - 1,348	108.7 %
Shore	WD	351	365	0 - 1,066	203.4 %
	WE	0	0	0 - 0	
Total Period B		7,746	1,439	4,925 - 10,566	36.4 %
Total August		42,034	6,272	29,740 - 54,328	29.2 %
			SEPTEMBER		
Period A (0800-1359 hours)					
Guided	WD	4,753	971	2,850 - 6,655	40.0 %
	WE	3,308	1,941	0 - 7,111	115.0 %
Unguided	WD	5,897	898	4,137 - 7,656	29.8 %
	WE	4,776	2,166	529 - 9,022	88.9 %
Shore	WD	0	0	0 - 0	
	WE	0	0	0 - 0	
Total Period A		18,733	3,195	12,470 - 24,995	33.4 %
Period B (1400-1959 hours)					
Guided	WD	1,274	200	881 - 1,667	30.8 %
	WE	199	57	87 - 311	56.4 %
Unguided	WD	2,032	354	1,339 - 2,726	34.1 %
	WE	1,101	292	529 - 1,673	52.0 %
Shore	WD	0	0	0 - 0	
	WE	0	0	0 - 0	
Total Period B		4,606	504	3,619 - 5,594	21.4 %
Total September		23,339	3,234	16,999 - 29,678	27.2 %

[a] WE = Weekend, WD = Weekday.

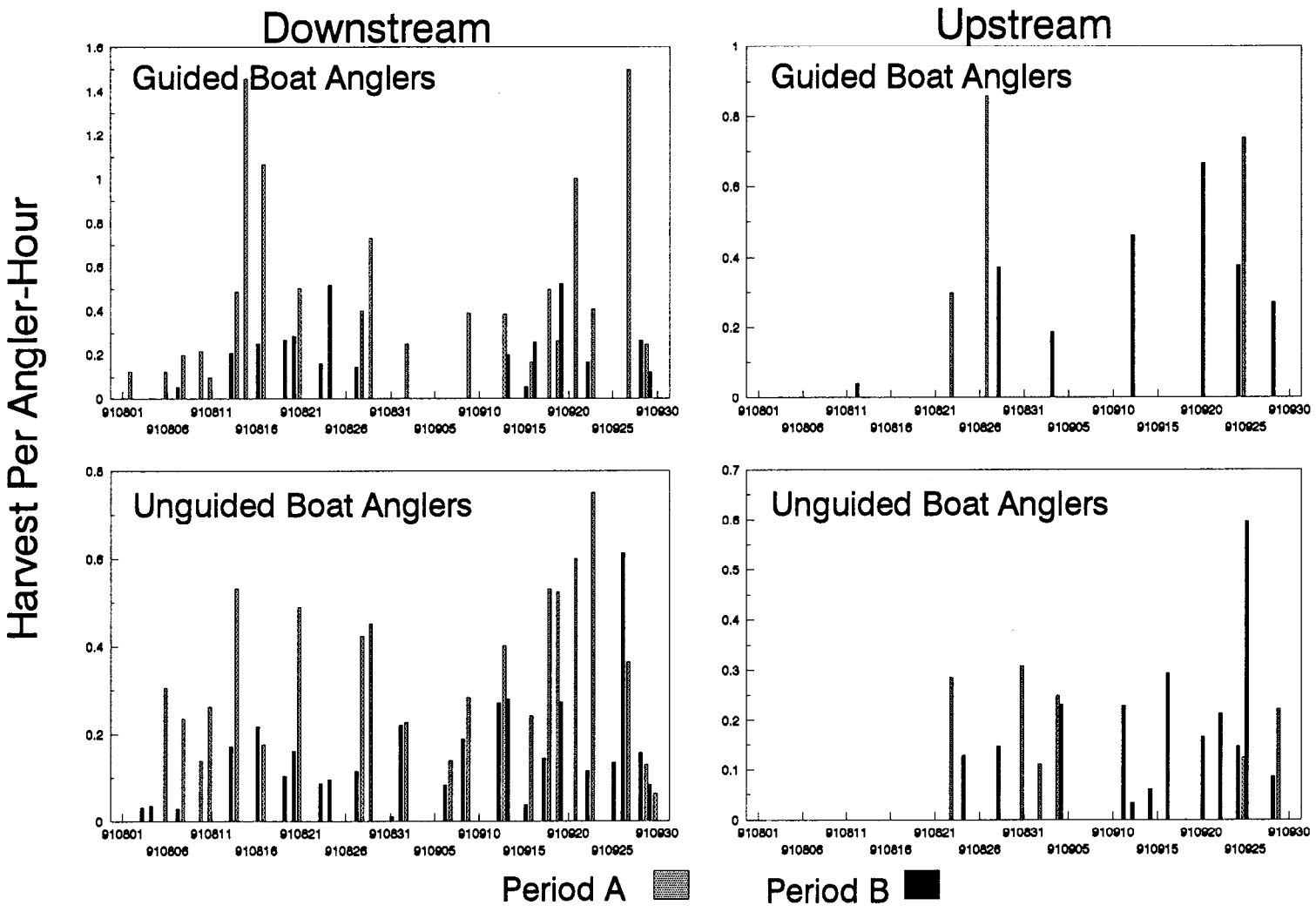

Figure 3. Number of coho salmon harvested per angler-hour by recreational anglers fishing in the downstream and upstream areas of the Kenai River, 1 August through 30 September 1991.

Upstream Section. A total of 337 completed-trip angler interviews were conducted in the upstream section, 161 during the early run and 176 during the late run. The greatest daily period harvest for guided anglers during the early run occurred on 27 August (Period A) when an estimated 142 coho salmon were caught and 75 harvested, and on 12 September (Period B) during the late run when 27 and 24 fish were caught and harvested, respectively (Appendix C1). Corresponding numbers for unguided anglers during the early run were 31 August (Period A) with an estimated catch and harvest of 453 coho salmon, and 25 September (Period B) when 167 fish were caught and harvested (Appendix C2). The greatest daily harvest and catch for shore anglers during the early run occurred on 24 August when an estimated 8 coho salmon were caught and harvested (Appendix C3). No coho salmon were estimated to have been caught or harvested by shore anglers during the late run (Appendix C3).

The total estimated harvest during the early run was 7,030 (SE = 3,255) coho salmon (Table 5) while the estimated catch was 7,722 (SE = 3,396) coho salmon (Table 6). The total estimated harvest during the late run was 3,372 (SE = 900) coho salmon (Table 5), while the estimated catch was 3,599 (SE = 907) coho salmon (Table 6). Significantly more fish were harvested during the morning hours (Period A) than during the evening hours (Period B) during the early run. This was not the case during the late run when roughly equal numbers of fish were taken in Period A and B. Guided anglers accounted for 25% of the early-run harvest and 16% of the late-run harvest. Shore anglers accounted for very little of the catch or harvest during either run. Harvest rate data for either run were inconclusive regarding peak run timing (Figure 3).

Season Summary:

Early Run. Total recreational angling effort, harvest, and catch during the early run totaled 206,037 angler-hours, 48,690 coho salmon, and 49,756 coho salmon, respectively (Table 7). All estimates were within desired levels of precision and accuracy planned for. Levels of effort and harvest during 1991 were similar to those reported in recent years and suggest an increasing trend in the fishery (Figure 2). The unguided component of the fishery accounted for the largest portion of the early-run effort while the guided portion of the fishery accounted for the largest portion of the early-run harvest and catch. Shore anglers accounted for the least proportion of effort, catch, and harvest.

Late Run. Total recreational angling effort, harvest, and catch during the late run totaled 104,867 angler-hours, 26,712 coho salmon, and 26,938 coho salmon, respectively (Table 7). All estimates were within desired levels of precision and accuracy planned for. Levels of effort and harvest during 1991 were similar to those reported in recent years and suggest an increasing trend in the fishery (Figure 2). The unguided component of the fishery accounted for the largest portion of the early-run effort, catch, and harvest. Shore anglers accounted for the least proportion of effort, catch, and harvest.

Biological Data

The most abundant age group in both the early and late run harvest of coho salmon was age 2.1 which composed 74.1% and 82.3% of the samples, respectively (Tables 8 and 9). The only other two age classes represented in appreciable

Table 5. Estimated harvest during each stratum of the fishery for coho salmon in the upstream section of the Kenai River, 1991.

Angler Type	WE/WD[a]	Estimated Harvest	Standard Error	95% Confidence Interval	Relative Precision
			AUGUST		
Period A (0600-1359 hours)					
Guided	(All Days)	1,536	738	89 - 2,983	94.2 %
Unguided	(All Days)	4,493	3,128	0 - 10,623	136.4 %
Shore	(All Days)	0	0	0 - 0	
Total Period A		6,029	3,214	0 - 12,328	104.5 %
Period B (1400-2159 hours)					
Guided	(All Days)	256	229	0 - 705	175.5 %
Unguided	(All Days)	705	460	0 - 1,606	127.8 %
Shore	(All Days)	40	37	0 - 112	180.3 %
Total Period B		1,001	515	0 - 2,010	100.8 %
Total August		7,030	3,255	651 - 13,409	90.7 %
			SEPTEMBER		
Period A (0800-1359 hours)					
Guided	(All Days)	310	49	214 - 406	31.1 %
Unguided	(All Days)	1,394	811	0 - 2,984	114.1 %
Shore	(All Days)	0	0	0 - 0	
Total Period A		1,704	813	111 - 3,297	93.5 %
Period B (1400-1959 hours)					
Guided	(All Days)	236	148	0 - 525	122.5 %
Unguided	(All Days)	1,432	358	730 - 2,134	49.0 %
Shore	(All Days)	0	0	0 - 0	
Total Period B		1,668	387	909 - 2,427	45.5 %
Total September		3,372	900	1,607 - 5,137	52.3 %

[a] WE = Weekend, WD = Weekday

Table 6. Estimated catch during each stratum of the fishery for coho salmon in the upstream section of the Kenai River, 1991.

Angler Type	WE/WD[a]	Estimated Catch	Standard Error	95% Confidence Interval	Relative Precision
			AUGUST		
Period A (0600-1359 hours)					
Guided	(All Days)	2,229	1,217	0 - 4,615	107.1 %
Unguided	(All Days)	4,493	3,128	0 - 10,624	136.4 %
Shore	(All Days)	0	0	0 - 0	
Total Period A		6,722	3,356	144 - 13,300	97.9 %
Period B (1400-2159 hours)					
Guided	(All Days)	256	229	0 - 705	175.5 %
Unguided	(All Days)	705	460	0 - 1,606	127.9 %
Shore	(All Days)	40	37	0 - 112	181.7 %
Total Period B		1,000	515	0 - 2,010	100.9 %
Total August		7,722	3,396	1,067 - 14,378	86.2 %
			SEPTEMBER		
Period A (0800-1359 hours)					
Guided	(All Days)	310	49	213 - 406	31.1 %
Unguided	(All Days)	1,394	811	0 - 2,985	114.1 %
Shore	(All Days)	0	0	0 - 0	
Total Period A		1,704	813	110 - 3,297	93.5 %
Period B (1400-1959 hours)					
Guided	(All Days)	354	188	0 - 721	104.0 %
Unguided	(All Days)	1,542	355	846 - 2,237	45.1 %
Shore	(All Days)	0	0	0 - 0	
Total Period B		1,895	401	1,108 - 2,682	41.5 %
Total September		3,599	907	1,822 - 5,376	49.4 %

[a] WE = Weekend, WD = Weekday

Table 7. Summary of angler effort and harvest and catch of coho salmon during August and September in two principal sections of the Kenai River, 1991.

		Effort			Harvest			Catch		
		Estimate	Standard Error	RP[a]	Estimate	Standard Error	RP[a]	Estimate	Standard Error	RP[a]
August										
Guided	Upstream	4,002	808	39.6 %	1,792	773	84.6 %	2,485	1,239	97.7 %
	Downstream	40,098	3,504	17.1 %	21,732	5,139	46.3 %	21,801	5,142	46.2 %
Subtotal		44,100	3,596	16.0 %	23,524	5,197	43.3 %	24,285	5,289	42.7 %
Unguided	Upstream	24,508	4,640	37.1 %	5,198	3,161	119.2 %	5,198	3,161	119.2 %
	Downstream	84,081	5,518	12.9 %	16,895	2,563	29.7 %	17,200	2,646	30.2 %
Subtotal		108,589	7,209	13.0 %	22,093	4,070	36.1 %	22,398	4,123	36.1 %
Shore	Upstream	16,319	7,233	86.9 %	40	37	180.3 %	40	37	181.7 %
	Downstream	37,030	2,477	13.1 %	3,033	2,428	156.9 %	3,033	2,428	156.9 %
Subtotal		53,348	7,646	28.1 %	3,073	2,428	154.9 %	3,073	2,428	154.9 %
Total	Upstream	44,829	8,632	37.7 %	7,030	3,255	90.7 %	7,722	3,396	86.2 %
	Downstream	161,208	6,990	8.5 %	41,660	6,235	29.3 %	42,034	6,272	29.2 %
Total August		206,037	11,107	10.6 %	48,690	7,033	28.3 %	49,756	7,132	28.1 %
September										
Guided	Upstream	2,645	310	23.0 %	546	155	55.8 %	663	194	57.3 %
	Downstream	23,065	808	6.9 %	9,534	2,180	44.8 %	9,534	2,180	44.8 %
Subtotal		25,710	866	6.6 %	10,080	2,185	42.5 %	10,197	2,188	42.1 %
Unguided	Upstream	19,261	2,230	22.7 %	2,826	887	61.5 %	2,936	886	59.1 %
	Downstream	45,722	1,287	5.5 %	13,806	2,390	33.9 %	13,805	2,390	33.9 %
Subtotal		64,983	2,575	7.8 %	16,632	2,549	30.0 %	16,741	2,548	29.8 %
Shore	Upstream	2,014	265	25.8 %	0	0		0	0	
	Downstream	12,159	318	5.1 %	0	0		0	0	
Subtotal		14,173	414	5.7 %	0	0		0	0	
Total	Upstream	23,920	2,267	18.6 %	3,372	900	52.3 %	3,599	907	49.4 %
	Downstream	80,947	1,553	3.8 %	23,340	3,234	27.2 %	23,339	3,234	27.2 %
Total September		104,867	2,748	5.1 %	26,712	3,357	24.6 %	26,938	3,359	24.4 %
Total Guided		69,810	3,699	10.4 %	33,604	5,638	32.9 %	34,482	5,724	32.5 %
Total Unguided		173,572	7,655	8.6 %	38,725	4,802	24.3 %	39,138	4,847	24.3 %
Total Shore		67,521	7,657	22.2 %	3,073	2,428	154.9 %	3,073	2,428	154.9 %
GRAND TOTAL		310,904	11,442	7.2 %	75,402	7,794	20.3 %	76,694	7,884	20.1 %

[a] Relative precision of 95% confidence interval.

Table 8. Age composition and mean length at age of coho salmon sampled from the recreational harvest during the fishery for coho salmon in the Kenai River, Alaska, 1991.

		Age Group				
	Sex	1.2	2.1	3.1	Other	Total
			AUGUST			
Percent	Male	1.9	37.1	7.8	0.7	47.5
	Female	5.9	37.0	7.8	1.8	52.5
	Combined	7.8	74.1	15.6	2.5	100.0
	SE	2.2	3.5	2.9	1.0	
Mean Length (mm)[a]	Male	538	591	647	585	
	SE	22	7	9		
	Sample size	3	57	12	1	73
	Female	524	587	630	590	
	SE	22	5	7	45	
	Sample size	9	57	12	3	81
			SEPTEMBER			
Percent	Male	0.6	36.6	7.9	0.0	45.1
	Female	0.6	45.7	8.6	0.0	54.9
	Combined	1.2	82.3	16.5	0.0	100.0
	SE	0.9	3.0	2.9	0.0	
Mean Length (mm)[a]	Male	500	632	655		
	SE		6	11		
	Sample size	1	60	13		74
	Female	450	619	625		
	SE		5	15		
	Sample size	1	75	14		90

[a] Lengths were measured mid-eye to fork-of-tail.

Table 9. Estimated number, by age class, of coho salmon harvested by the recreational fishery on the Kenai River below Skilak Lake during 1991.

			Age Group				
Stratum	Sex	Statistic	1.1	1.2	1.3	Other	Total
August	Male	Sample Size	3	57	12	1	73
(n=154)		Percent	1.9	37.0	7.8	0.6	47.4
		SE	1.12	3.90	2.17	0.65	4.04
		Number	949	18,022	3,794	316	23,080
		SE	555	3,212	1,179	316	
	Female	Sample Size	9	57	12	3	81
		Percent	5.8	37.0	7.8	1.9	52.6
		SE	1.90	3.90	2.17	1.12	4.04
		Number	2,846	18,022	3,794	949	25,610
		SE	1,002	3,212	1,179	555	
	Combined	Sample Size	12	114	24	4	154
		Percent	7.8	74.0	15.6	2.6	100.0
		SE	2.17	3.54	2.93	1.29	0.00
		Number	3,794	36,043	7,588	1,265	48,690
		SE	1,179	5,480	1,788	646	7,034
September	Male	Sample Size	1	60	13	0	74
(n=164)		Percent	0.6	36.6	7.9	0	45.1
		SE	0.61	3.77	2.12	0.00	3.90
		Number	163	9,773	2,117	0	12,053
		SE	163	1,584	621	0	
	Female	Sample Size	1	75	14	0	90
		Percent	0.6	45.7	8.5	0	54.9
		SE	0.61	3.90	2.19	0.00	3.90
		Number	163	12,216	2,280	0	14,659
		SE	163	1,851	647	0	
	Combined	Sample Size	2	135	27	0	164
		Percent	1.2	82.3	16.5	0	100.0
		SE	0.86	2.99	2.90	0.00	0.00
		Number	326	21,989	4,398	0	26,712
		SE	231	2,875	948	0	3,357

proportions in the sample were 1.1 (7.8%) and 3.1 (15.6%) during the early run, and 1.1 (1.2%) and 3.1 (16.5%) during the late run. There was no significant difference in the age compositions of coho salmon harvested during the early and late runs ($\chi^2 = 8.48$, df = 2, $p > 0.10$). Mean lengths increased with age for each sex during both runs (Table 8). The sex ratio of the recreational harvest indicated more females than males were taken (Table 8).

RECOMMENDATIONS

No significant changes in the creel survey program are recommended for the 1992 field season. As long as the regulations remain unchanged, the management objectives are consistent, and no major changes occur in the characteristics of the recreational fishery, the current design is appropriate. However, the assumptions that were tested for the chinook salmon creel survey program (Conrad and Hammarstrom 1987) should be tested for the coho fishery as well. If the assumptions are valid for the coho fishery, a similar design would also be appropriate for both fisheries.

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APPENDIX A

Counts of boat anglers during the creel survey of the fishery for coho salmon on the Kenai River, Alaska, 1991.

Appendix A1. Angler counts by stratum during the recreational fishery for coho salmon in the downstream section, Kenai River, during August 1991.

	GUIDED ANGLERS						UNGUIDED ANGLERS						SHORE ANGLERS					
	STRATUM A			STRATUM B			STRATUM A			STRATUM B			STRATUM A			STRATUM B		
DATE	Count			Count			Count			Count			Count			Count		
	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
8/01	20						22						176					
8/02	40	30					24	35					70	71				
8/03	44	75	62	14	0		29	104	132	121	110		47	107	110	110	84	
8/04	31			29	6		132			105	60		67			73	59	
8/06	98	118	138				44	74	103				20	43	57			
8/07				45	32	15				163	179	196				71	107	105
8/08	223	241	205				141	161	155				52	94	80			
8/10	187	217	183	70	53	15	183	312	300	140	267	199	53	77	61	118	114	105
8/11	154	181	152				159	191	197				18	51	67			
8/13				96	61	22				91	96	135				58	45	81
8/14	145	212	168				93	216	243				17	49	92			
8/15	191	175	138				72	194	208				10	40	46			
8/16				88	43	31				286	218	175				124	87	64
8/17	234	175	143				308	403	420				41	62	47			
8/19				46	35	20				214	208	216				112	122	96
8/20				73	56	106				231	221	277				82	90	100
8/21	139	176	161				174	267	165				67	107	108			
8/23				81	66	38				255	274	301				86	78	99
8/24				101	63	4				371	357	139				88	72	33
8/25	114	91	32				418	286	252				96	108	96			
8/27				41	32	18				112	124	124				74	66	41
8/28	100	102	64				116	249	239				8	50	59			
8/29	96	94	90				157	185	128				12	42	73			
8/30				37	34	9				80	66	154				50	46	28
8/31				31	18	27				244	166	110				88	86	32

Appendix A2. Angler counts by stratum during the recreational fishery for coho salmon in the downstream section, Kenai River, during September 1991.

	GUIDED ANGLERS						UNGUIDED ANGLERS						SHORE ANGLERS					
	STRATUM A			STRATUM B			STRATUM A			STRATUM B			STRATUM A			STRATUM B		
DATE	Count			Count			Count			Count			Count			Count		
	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
9/01				50	53	13				244	219	180				96	91	65
9/02	87	77	52				281	236	117				63	76	74			
9/06	113	103	89	52	48	41	136	120	80	117	120	59	62	71	79	30	32	29
9/07	413	156	145				40	377	387				6	71	69			
9/08				60	60	49				109	115	85				39	32	28
9/09	145	137	133				135	160	128				34	32	42			
9/12				56	44	7				123	109	106				59	52	10
9/13	122	93	69	62	39	39	298	156	84	87	92	99	43	38	45	39	28	34
9/15				52	23	17				159	119	71				61	52	19
9/16	68	73	47	51	37	18	123	140	71	92	67	70	27	33	29	33	25	31
9/17				52	33	6				85	67	70				22	22	24
9/18	90	88	89				133	116	105				39	28	29			
9/19	105	88	70	35	29	22	151	141	130	98	82	58	27	22	28	16	18	14
9/21	143	133	121				371	346	330				57	52	48			
9/22				28	9	4				89	54	21				12	11	5
9/23	75	57	46				111	105	90				32	30	38			
9/25				15	17	14				59	60	56				6	5	5
9/26				9	10	12				32	25	24				6	5	6
9/27	53	59	64				113	105	120				11	8	10			
9/28				26	22	23				188	176	150				56	47	35
9/29	69	62	47	31	20	21	249	177	134	92	74	58	25	36	43	38	32	28
9/30	77	62					23	25					7	12				

Appendix A3. Angler counts by stratum during the recreational fishery for coho salmon in the upstream section, Kenai River, during August 1991.

	GUIDED ANGLERS						UNGUIDED ANGLERS						SHORE ANGLERS					
	STRATUM A			STRATUM B			STRATUM A			STRATUM B			STRATUM A			STRATUM B		
DATE	Count			Count			Count			Count			Count			Count		
	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
8/03	10	15					66	124					221	288				
8/04				18	0	4				61	33	21				139	108	78
8/07	7	15	10				15	47	36				8	25	42			
8/08				10	0	0				58	34	17				30	14	11
8/11	0	0	0				7	14	60				0	26	27			
8/12				3	3					33	20					7	3	
8/15	0	5	3				4	8	20				1	4	17			
8/16				3	0					24	17					13	11	
8/20				14						47						10		
8/21	14	8					35	43					12	9				
8/23	24	37					50	61					2	16				
8/24				4	0					129	13					10	9	
8/27	11						34						1					
8/28				10	7	7				31	35	36				4	4	1
8/31	5	7					141	227					11	12				

Appendix A4. Angler counts by stratum during the recreational fishery for coho salmon in the upstream section, Kenai River, during September 1991.

	GUIDED ANGLERS						UNGUIDED ANGLERS						SHORE ANGLERS					
	STRATUM A			STRATUM B			STRATUM A			STRATUM B			STRATUM A			STRATUM B		
DATE	Count			Count			Count			Count			Count			Count		
	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3	#1	#2	#3
9/02	13	16	21				145	140	159				11	12	9			
9/03					14	2					6	6					3	0
9/04	15	15	9	19	10	0	31	21	9	15	23	24	2	0	5	11	1	2
9/05	9	4	10				24	23	24				0	0	0			
9/06	11	19	19				33	30	31				8	3	1			
9/10	8	11	4				24	39	31				0	1	0			
9/11				11	11	11				21	27	45				1	5	4
9/12	6	16	19	13	13	0	45	51	54	45	45	24	4	4	4	6	6	6
9/14				8	8	4				116	86	45				7	17	3
9/15	5	5	0				75	102	82				5	6	7			
9/16				4	0	0				36	18	16				2	8	3
9/20	10	7	5	7	2	0	47	62	50	60	62	56	7	6	5	7	6	6
9/21	17	17	17				154	169	156				7	8	11			
9/22				0	0	0				61	16	6				13	1	0
9/23	8	8	3				41	33	38				3	5	4			
9/24				4	4	2				18	24	48				1	4	0
9/25	7	0	0	0	0	0	42	54	52	52	50	38	9	5	0	6	2	7
9/28				3	0					92	59					14	16	
9/29	4	10					135	118					19	14				

APPENDIX B

Daily summary statistics for fishing effort, harvest rate, and catch rate for anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River, Alaska, 1991.

Appendix B1. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by guided anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during August 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910801	A	160	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910802	A	280	1,600	2	0.1250	0.0156	35	1,225	0.1250	0.0156	35	1,225
910803	A	483	6,027	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910803	B	56	3,136	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	A	248	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	140	8,464	9	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910806	A	944	4,267	4	0.1250	0.0017	118	1,606	0.1250	0.0017	118	1,606
910807	B	245	2,443	3	0.0556	0.0031	14	186	0.0556	0.0031	14	186
910808	A	1,784	8,640	8	0.2000	0.0039	357	12,582	0.2000	0.0039	357	12,582
910810	A	1,565	10,965	11	0.2156	0.0079	337	19,887	0.2156	0.0079	337	19,887
910810	B	368	9,243	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	1,299	8,373	8	0.1006	0.0041	131	7,023	0.1006	0.0041	131	7,023
910813	B	477	14,645	26	0.2100	0.0007	100	795	0.2100	0.0007	100	795
910814	A	1,400	34,267	31	0.4891	0.0009	685	9,856	0.5068	0.0010	710	10,644
910815	A	1,344	8,667	12	1.4583	0.0017	1,960	21,553	1.4583	0.0017	1,960	21,553
910816	B	432	11,568	37	0.2539	0.0007	110	867	0.2539	0.0007	110	867
910817	A	1,472	24,027	8	1.0655	0.0012	1,568	29,828	1.0655	0.0012	1,568	29,828
910819	B	269	1,845	9	0.2712	0.0071	73	639	0.2712	0.0071	73	639
910820	B	627	14,875	13	0.2887	0.0044	181	2,884	0.2887	0.0044	181	2,884
910821	A	1,269	8,501	38	0.5037	0.0029	639	6,763	0.5037	0.0029	639	6,763
910823	B	493	5,381	12	0.1619	0.0025	80	727	0.1619	0.0025	80	727
910824	B	448	26,267	5	0.5200	0.0064	233	8,219	0.5200	0.0064	233	8,219
910825	A	632	21,387	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910827	B	243	1,477	5	0.1455	0.0021	35	155	0.1455	0.0021	35	155
910828	A	709	7,723	4	0.4000	0.0200	284	11,144	0.4000	0.0200	284	11,144
910829	A	747	107	15	0.7297	0.0048	545	2,753	0.7297	0.0048	545	2,753
910830	B	213	3,381	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910831	B	203	1,333	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] Period A=0600-1359 hours, B=1400-2159 hours.

[b] Anglers interviewed.

Appendix B2. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by unguided anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during August 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910801	A	176	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910802	A	236	1,936	4	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910803	A	707	34,181	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910803	B	924	1,936	8	0.0302	0.0014	28	1,222	0.0302	0.0014	28	1,222
910804	A	1,056	0	5	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	660	32,400	25	0.0341	0.0003	23	179	0.0341	0.0003	23	179
910806	A	589	9,285	7	0.3060	0.0069	180	3,213	0.3060	0.0069	180	3,213
910807	B	1,435	2,907	8	0.0288	0.0008	41	1,589	0.0288	0.0008	41	1,589
910808	A	1,219	2,325	6	0.2345	0.0273	286	40,567	0.2345	0.0273	286	40,567
910810	A	2,120	89,520	27	0.1380	0.0023	293	11,793	0.1380	0.0023	293	11,793
910810	B	1,616	110,683	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	1,459	5,653	12	0.2610	0.0050	381	10,931	0.2610	0.0050	381	10,931
910813	B	859	8,245	23	0.1706	0.0020	146	1,693	0.1992	0.0030	171	2,509
910814	A	1,472	84,576	22	0.5314	0.0103	782	45,351	0.5827	0.0117	858	53,120
910815	A	1,264	80,427	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910816	B	1,811	34,523	45	0.2165	0.0008	392	4,146	0.2165	0.0008	392	4,146
910817	A	3,016	49,675	5	0.1741	0.0052	525	48,714	0.1741	0.0052	525	48,714
910819	B	1,701	533	13	0.1039	0.0047	177	13,471	0.1039	0.0047	177	13,471
910820	B	1,944	17,259	27	0.1606	0.0025	312	9,939	0.1606	0.0025	312	9,939
910821	A	1,616	101,616	42	0.4893	0.0022	791	29,905	0.4893	0.0022	791	29,905
910823	B	2,213	5,813	18	0.0867	0.0009	192	4,225	0.0867	0.0009	192	4,225
910824	B	2,312	254,507	46	0.0963	0.0005	223	4,752	0.0963	0.0005	223	4,752
910825	A	2,549	99,093	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910827	B	960	768	22	0.1148	0.0023	110	2,124	0.1148	0.0023	110	2,124
910828	A	1,611	94,875	15	0.4222	0.0050	680	29,365	0.4222	0.0050	680	29,365
910829	A	1,253	21,509	10	0.4510	0.0052	565	12,432	0.4510	0.0052	565	12,432
910830	B	800	42,347	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910831	B	1,387	49,173	19	0.0102	0.0001	14	216	0.0102	0.0001	14	216

[a] Period A=0600-1359 hours, B=1400-2159 hours.

[b] Anglers interviewed.

Appendix B3. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by shore anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during August 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910801	A	1,408	0	1	0.2500	0.0000	352	0	0.2500	0.0000	352	0
910802	A	564	16	2	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910803	A	704	19,248	16	0.0477	0.0012	34	602	0.0477	0.0012	34	602
910803	B	776	10,816	2	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	A	536	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	528	3,136	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910806	A	320	3,867	4	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910807	B	755	6,933	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910808	A	603	10,453	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910810	A	509	4,437	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910810	B	899	517	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	363	7,173	3	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910813	B	491	7,813	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910814	A	421	15,323	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910815	A	256	4,992	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910816	B	733	10,123	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910817	A	400	3,552	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910819	B	880	4,139	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910820	B	725	875	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910821	A	752	8,539	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910823	B	701	2,693	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910824	B	515	9,477	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910825	A	800	1,536	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910827	B	483	3,675	5	0.0662	0.0082	32	1,885	0.0662	0.0082	32	1,885
910828	A	312	9,840	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910829	A	339	9,925	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910830	B	331	1,813	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910831	B	549	15,573	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] Period A=0600-1359 hours, B=1400-2159 hours.

[b] Anglers interviewed.

Appendix B4. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by guided anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910901	B	232	4,827	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910902	A	432	2,175	8	0.2530	0.0035	109	787	0.2530	0.0035	109	787
910906	A	610	888	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	B	282	195	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910907	A	1,428	198,510	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910908	B	338	363	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910909	A	830	240	12	0.3900	0.0044	324	3,043	0.3900	0.0044	324	3,043
910912	B	214	4,539	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910913	A	568	4,251	6	0.3846	0.0141	218	5,104	0.3846	0.0141	218	5,104
910913	B	280	13,119	10	0.1988	0.0058	56	897	0.1988	0.0058	56	897
910915	B	184	2,631	9	0.0575	0.0018	11	65	0.0575	0.0018	11	65
910916	A	376	2,103	5	0.1667	0.0111	63	1,606	0.1667	0.0111	63	1,606
910916	B	212	9,474	16	0.2603	0.0019	55	709	0.2603	0.0019	55	709
910917	B	182	3,270	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910918	A	534	15	9	0.5000	0.0000	267	4	0.5000	0.0000	267	4
910919	A	447	2,757	9	0.2658	0.0032	119	823	0.2658	0.0032	119	823
910919	B	153	8,010	6	0.5250	0.0023	80	2,243	0.5250	0.0023	80	2,243
910921	A	794	732	4	1.0000	0.0000	794	732	1.0000	0.0000	794	732
910922	B	82	1,158	3	0.1667	0.0093	14	84	0.1667	0.0093	14	84
910923	A	356	1,335	13	0.4068	0.0127	145	1,820	0.4068	0.0127	145	1,820
910925	B	92	39	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910926	B	62	15	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910927	A	352	183	3	1.5000	0.0000	528	412	1.5000	0.0000	528	412
910928	B	142	51	4	0.2667	0.0089	38	182	0.2667	0.0089	38	182
910929	A	356	822	4	0.2500	0.0078	89	1,035	0.2500	0.0078	89	1,035
910929	B	144	3,249	8	0.1216	0.0031	18	102	0.1216	0.0031	18	102
910930	A	417	2,025	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] Period A=0800-1359 hours, B=1400-1959 hours.

[b] Anglers interviewed.

Appendix B5. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by unguided anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910901	B	1,286	6,438	13	0.2199	0.0036	283	6,314	0.2199	0.0036	283	6,314
910902	A	1,268	48,558	30	0.2269	0.0033	288	7,608	0.2269	0.0033	288	7,608
910906	A	672	5,568	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	B	592	11,190	3	0.0833	0.0069	49	2,434	0.0833	0.0069	49	2,434
910907	A	1,608	341,007	37	0.1393	0.0013	224	9,504	0.1393	0.0013	224	9,504
910908	B	618	2,808	18	0.1900	0.0046	117	1,827	0.1900	0.0046	117	1,827
910909	A	846	4,947	13	0.2838	0.0050	240	3,955	0.2838	0.0050	240	3,955
910912	B	676	615	24	0.2694	0.0008	182	425	0.2694	0.0008	182	425
910913	A	1,076	76,044	23	0.4012	0.0056	432	18,309	0.4012	0.0056	432	18,309
910913	B	556	22,929	14	0.2803	0.0018	156	2,305	0.2803	0.0018	156	2,305
910915	B	698	11,712	12	0.0377	0.0014	26	675	0.0377	0.0014	26	675
910916	A	790	1,059	17	0.2405	0.0049	190	3,105	0.2405	0.0049	190	3,105
910916	B	458	27,294	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910917	B	444	999	17	0.1438	0.0015	64	318	0.1438	0.0015	64	318
910918	A	708	1,230	14	0.5295	0.0025	375	1,589	0.5295	0.0025	375	1,589
910919	A	780	1,868	19	0.5238	0.0094	409	6,184	0.5238	0.0094	409	6,184
910919	B	420	65,700	25	0.2719	0.0040	114	5,302	0.2719	0.0040	114	5,302
910921	A	2,094	2,643	6	0.5991	0.0503	1,255	221,282	0.5991	0.0503	1,255	221,282
910922	B	328	6,942	28	0.1150	0.0007	38	159	0.1150	0.0007	38	159
910923	A	612	783	9	0.7500	0.0118	459	4,864	0.7500	0.0118	459	4,864
910925	B	350	51	4	0.1339	0.0085	47	1,046	0.1339	0.0085	47	1,046
910926	B	162	150	7	0.6117	0.0547	99	1,483	0.6117	0.0547	99	1,483
910927	A	676	867	18	0.3633	0.0099	246	4,616	0.3633	0.0099	246	4,616
910928	B	1,028	2,460	27	0.1549	0.0016	159	1,696	0.1549	0.0016	159	1,696
910929	A	1,120	21,099	10	0.1286	0.0062	144	8,032	0.1286	0.0062	144	8,032
910929	B	448	27,132	12	0.0827	0.0025	37	612	0.0827	0.0025	37	612
910930	A	144	36	5	0.0612	0.0034	9	71	0.0612	0.0034	9	71

[a] Period A=0800-1359 hours, B=1400-1959 hours.

[b] Anglers interviewed.

Appendix B6. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by shore anglers interviewed during the fishery for coho salmon in the downstream section of the Kenai River during September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910901	B	504	2,103	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910902	A	426	519	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	A	424	435	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	B	182	39	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910907	A	292	12,687	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910908	B	198	195	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910909	A	216	312	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910912	B	242	5,439	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910913	A	252	222	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910913	B	202	5,034	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910915	B	264	3,510	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910916	A	178	156	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910916	B	178	3,567	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910917	B	136	12	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910918	A	192	366	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910919	A	140	308	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910919	B	96	3,060	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910921	A	314	123	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910922	B	56	111	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910923	A	200	204	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910925	B	32	3	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910926	B	34	6	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910927	A	58	39	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910928	B	276	675	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910929	A	208	510	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910929	B	196	4,488	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910930	A	57	225	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] Period A=0800-1359 hours, B=1400-1959 hours.

[b] Anglers interviewed.

APPENDIX C

Daily summary statistics for fishing effort, harvest rate, and catch rate for anglers interviewed during the fishery for coho salmon in the upstream section of the Kenai River, Alaska, 1991.

Appendix C1. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by guided anglers interviewed during the fishery for coho salmon in the upstream section of the Kenai River during August and September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910803	A	100	400	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	59	1,813	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910807	A	85	475	7	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910808	B	27	533	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	0	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910812	B	24	0	4	0.0417	0.0017	1	1	0.0417	0.0017	1	1
910815	A	21	155	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910816	B	12	144	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910820	B	112	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910821	A	88	576	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910823	A	244	2,704	4	0.3000	0.0167	73	1,191	0.3000	0.0167	73	1,191
910824	B	16	256	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910827	A	88	0	3	0.8571	0.0000	75	0	1.6190	0.0091	142	70
910828	B	64	48	5	0.3714	0.0033	24	20	0.3714	0.0033	24	20
910831	A	48	64	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910902	A	100	102	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910903	B	48	3,060	8	0.1875	0.0028	9	105	0.2656	0.0081	13	210
910904	A	78	108	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910904	B	58	1,626	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910905	A	46	183	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	A	98	192	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910910	A	46	174	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910911	B	66	0	3	0.0000	0.0000	0	0	0.2222	0.0123	15	54
910912	A	82	327	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910912	B	52	1,014	3	0.4615	0.0000	24	216	0.5128	0.0026	27	271
910914	B	40	48	3	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910915	A	20	75	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910916	B	8	48	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910920	A	44	39	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910920	B	18	234	2	0.6667	0.0000	12	104	0.6667	0.0000	12	104
910921	A	102	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910922	B	0	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910923	A	38	75	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910924	B	20	12	4	0.3750	0.0000	8	2	0.6563	0.0088	13	9
910925	A	14	147	3	0.7374	0.0102	10	80	0.7374	0.0102	10	80
910925	B	0	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910928	B	9	81	9	0.2721	0.0024	2	6	0.3628	0.0078	3	11
910929	A	42	324	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] August - Period A=0600-1359 hours, B=1400-2159 hours.
September - Period A=0800-1359 hours, B=1400-1959 hours.

[b] Anglers interviewed.

Appendix C2. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by unguided anglers interviewed during the fishery for coho salmon in the upstream section of the Kenai River during August and September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910803	A	760	53,824	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	307	4,949	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910807	A	261	6,107	18	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910808	B	291	4,613	9	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	216	11,547	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910812	B	212	2,704	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910815	A	85	853	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910816	B	164	784	5	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910820	B	376	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910821	A	312	1,024	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910823	A	444	1,936	2	0.2857	0.0000	127	158	0.2857	0.0000	127	158
910824	B	568	215,296	18	0.1297	0.0012	74	3,751	0.1297	0.0012	74	3,751
910827	A	272	0	2	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910828	B	272	91	3	0.1471	0.0200	40	1,478	0.1471	0.0200	40	1,478
910831	A	1,472	118,336	3	0.3077	0.0079	453	27,365	0.3077	0.0079	453	27,365
910902	A	808	4,758	2	0.1111	0.0123	90	8,060	0.1111	0.0123	90	8,060
910903	B	36	324	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910904	A	122	732	2	0.2500	0.0000	31	46	0.2500	0.0000	31	46
910904	B	124	870	5	0.2305	0.0204	29	341	0.2305	0.0204	29	341
910905	A	142	6	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	A	188	30	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910910	A	188	867	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910911	B	186	1,080	8	0.2281	0.0085	42	342	0.3193	0.0198	59	775
910912	A	300	135	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910912	B	228	7,398	9	0.0338	0.0010	8	55	0.0662	0.0017	15	106
910914	B	494	7,743	11	0.0600	0.0012	30	318	0.0600	0.0012	30	318
910915	A	518	3,387	2	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910916	B	140	1,212	7	0.2930	0.0057	41	209	0.3799	0.0058	53	282
910920	A	318	1,107	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910920	B	356	10,920	2	0.1667	0.0000	59	303	0.1667	0.0000	59	303
910921	A	958	1,182	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910922	B	166	6,375	36	0.2134	0.0020	35	334	0.2134	0.0020	35	334
910923	A	224	267	2	0.0000	1.0000	0	49,909	0.0000	1.0000	0	49,909
910924	B	180	1,836	12	0.1471	0.0033	26	141	0.1471	0.0033	26	141
910925	A	296	444	2	0.1250	0.0156	37	1,369	0.1250	0.0156	37	1,369
910925	B	280	8,556	3	0.5972	0.0216	167	4,561	0.5972	0.0216	167	4,561
910928	B	453	9,801	32	0.0871	0.0007	39	205	0.0871	0.0007	39	205
910929	A	759	2,601	5	0.2214	0.0072	168	4,281	0.2214	0.0072	168	4,281

[a] August - Period A=0600-1359 hours, B=1400-2159 hours.
September - Period A=0800-1359 hours, B=1400-1959 hours.

[b] Anglers interviewed.

Appendix C3. Daily summary statistics for fishing effort, coho salmon harvest and catch rates by shore anglers interviewed during the fishery for coho salmon in the upstream section of the Kenai River during August and September 1991.

		Estimated		Ang	HPUE		Estimated		CPUE		Estimated	
Date	Period[a]	Effort	Variance	Int[b]	Mean	Variance	Harvest	Variance	Mean	Variance	Catch	Variance
910803	A	2,036	71,824	17	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910804	B	867	9,925	17	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910807	A	200	3,083	9	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910808	B	147	1,413	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910811	A	141	3,611	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910812	B	40	256	3	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910815	A	59	949	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910816	B	96	64	6	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910820	B	80	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910821	A	84	144	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910823	A	72	3,136	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910824	B	76	16	9	0.1012	0.0027	8	16	0.1012	0.0027	8	16
910827	A	8	0	1	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910828	B	24	48	2	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910831	A	92	16	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910902	A	64	30	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910903	B	9	162	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910904	A	14	87	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910904	B	28	666	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910905	A	0	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910906	A	24	87	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910910	A	2	6	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910911	B	20	51	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910912	A	24	0	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910912	B	36	108	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910914	B	54	888	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910915	A	36	6	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910916	B	26	183	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910920	A	36	6	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910920	B	38	150	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910921	A	52	30	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910922	B	28	435	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910923	A	24	15	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910924	B	10	75	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910925	A	28	123	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910925	B	30	231	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910928	B	90	36	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0
910929	A	99	225	0	0.0000	0.0000	0	0	0.0000	0.0000	0	0

[a] August - Period A=0600-1359 hours, B=1400-2159 hours.
September - Period A=0800-1359 hours, B=1400-1959 hours.
[b] Anglers interviewed.